

Title: Selective Digestive Decontamination in Critically Ill Children: A Survey of Canadian Providers

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Abstract

Background:

Selective Digestive Decontamination involves the routine administration of oral, gastric, and intravenous antibiotics to mechanically ventilated children to prevent hospital-acquired infections. It has a strong evidence base in adults, with limited pediatric data. Knowledge of the practice among pediatric providers in North America is unknown.

Methods:

This is an electronic survey administered to pediatric critical care and pediatric infectious disease providers in Canada. Questions were asked regarding current institutional practice, their current knowledge regarding the evidence, and perceptions as to its risks and benefits. Descriptive statistics were analyzed.

Results:

The overall survey response rate was 33%, for a total of 47 responses. No hospital in Canada routinely performs SDD and the majority of respondents (73.9%) have neutral opinions on the subject. There was concern for increasing antibiotic resistance (43.1%) and some disagreement with the intravenous component of SDD (47%). The majority of respondents stated a need for pediatric-specific data before integrating SDD into their practice, even if further, large adult RCTs were performed.

Conclusion:

Among Canadian providers, there is minimal knowledge or use of selective digestive decontamination as a tool for preventing hospital-acquired infections. Before further interventional studies are performed, there is a need for educational interventions to assess readiness and acceptability of the intervention.

Background

Hospital-acquired infections remain a major contributor to morbidity and mortality among critically ill children around the world.[1-4] The costs of these infections are large, and estimated costs are over 40,000 dollars to hospital charges among critically ill children in the United States, for example.[5] The microbiologic etiology of many of these infections are commensal or opportunistic organisms that live in the oropharynx and upper digestive tract, often causing infection-related ventilator-associated complications or translocating across mucosal layers to cause bloodstream infections.[6, 7]

Evidence-based recommendations to prevent these infections typically involve removing the foreign material at the earliest possible opportunity and ensuring that bacterial entry into lungs or blood is minimized.[8, 9] Decontamination of these opportunistic organisms through administration of specific antibiotics has been extensively studied in adult populations, with a sizable benefit documented in mortality among critically ill adults.[10-13] However, the use of these decontamination protocols has been limited, even within adult critical care units, primarily due to concerns among clinicians about fomenting further antibiotic resistance, as well as side-effects of antibiotic administration. [14, 15]

In children, there is evidence, primarily generated from areas of Europe, that selective digestive decontamination reduces the incidence of hospital-acquired pneumonia.[16] Determining the baseline knowledge of providers in a jurisdiction that has not traditionally performed digestive decontamination is crucial before determining whether further study is warranted in the critically ill child.

Methods

Study setting: Between May and July 2016, a national survey was conducted among Canadian pediatric ID and critical care specialists regarding their knowledge surrounding selective digestive decontamination (SDD) in critically ill children. Approval for the survey was granted by the research ethics board at BC Children's Hospital and the University of British Columbia (Vancouver, Canada).

Survey Design: The survey consisted of 16 short questions regarding SDD, including understanding their current institutional practice, their current knowledge regarding the evidence, and perceptions as to its risks and benefits. Further, questions were asked to ascertain comfort with performing a trial and in incorporating evidence from data generated in adult patients into pediatric practice. The survey was adapted from a validated instrument used in adults, as part of the SUDDICU program of research.[14] The adapted version was pilot tested on 5 specialists to determine ease of use and time required, and no major changes were made to the survey during this process.[17]

Survey Administration: The survey was anonymous, confidential and self-administered by clinicians via REDCAP[18] through two separate electronic mail-outs. Pediatric infectious diseases specialists were identified through being on-staff at the academic teaching hospitals in Canada (n=57), and pediatric critical care

specialists were identified through prior survey lists generated through the Canadian Critical Care Trials Group (n=115).
Statistical Analysis: A descriptive analysis of familiarity with SDD included reporting summary statistics and graphical displays of the distribution of responses. Univariate statistical tests were performed across groups by years in practice and specialty.

Results

From the 172 individuals on the two electronic lists, 143 email addresses were valid; of these, 47 responded to the survey, for a response rate of 33%. This low response rate was attributed to the summer months, as well as a global unfamiliarity with the concept of SDD. Of the 47 respondents, 39 identified as critical care physicians, 7 as infectious disease physicians, and 1 as an infection control specialist. The years in practice varied, with 36% having between 5 and 10 years experience, 25% having between 10 and 20, and 30% having more than 20 years clinical experience.

No individual in Canada reported delivering SDD routinely to critically ill children, with only one individual claiming to deliver SDD in a non-protocolized fashion. The majority of respondents (63.8%) claimed to have below-neutral knowledge of the evidence base for SDD, and to have a neutral opinion (73.9%) regarding its use. 47% of respondents were somewhat or strongly opposed to the intravenous component of SDD and 40.4% thought that using SDD increased antibiotic resistance. A small number of individuals felt that SDD reduced the incidence of VAP (34%).

The majority of individuals had neutral opinions on the risk-benefit profile of SDD (67%), that it benefited the patients to whom it was delivered (77.3%), and that it reduced mortality (76.1%).

In the absence of further pediatric-specific trial data, evidence from adult randomized trials that documented a 3.5% reduction in mortality would convince only 34% of respondents to incorporate SDD into their pediatric practice. In the absence of further adult randomized evidence, 60% of respondents think that performing randomized trials in children is reasonable. 62% of respondents think that the results of SDD will be very different in children than in adults.

There was no statistically significant difference in responses by years spent in practice or primary area of practice.

Discussion

In this survey of Canadian providers, selective digestive decontamination was not performed, and very little knowledge of the evidence base was apparent. There was ongoing concern for spreading antibiotic resistance, although many wanted a pediatric-specific study to be performed, thinking that the results in a pediatric study will be very different than those in adult studies.

1 These results are unsurprising, given the complicated history of SDD around the
2 world. Despite fairly high-level evidence, its practice has not been disseminated
3 outside of certain jurisdictions for a variety of reasons, including conflicting
4 evidence of benefit in the adult literature, concerns for antibiotic resistance, and
5 lack of pediatric-specific evidence.[19-21] Because of this, knowledge surrounding
6 SDD is limited, especially among pediatric providers.

7
8 Incorporating adult-based evidence into pediatric practice is a controversial subject.
9 [22, 23] Pediatric populations are likely to be different than adult populations in
10 their response to SDD. The different flora present in the digestive tracts in children,
11 especially neonates, compared with adults will likely impact the effects of any
12 digestive decontamination protocols.. The incidence of VAP and mortality in
13 critically ill children is much lower than in adults, altering any outcome analysis.
14 Further, the numbers of critically ill children who are mechanically ventilated for 2
15 or more days are small, making sample size estimates for a large trial
16 prohibitive.[16]

17
18 The limitations of this study are few. First, the response rate was relatively low for a
19 survey of this sort, especially among infectious disease physicians; responses among
20 intensive care clinicians were much higher, perhaps more reflective of the nature of
21 the intervention. Second, this survey captured only opinions, and did not perform
22 in-depth interviews with subjects regarding their knowledge surrounding SDD. This
23 was performed due to practicality, as well as presuming a very minimal level of
24 knowledge surrounding SDD among pediatric providers.

25 **Conclusion**

26 Among pediatric providers in Canada, there was very limited knowledge
27 surrounding selective digestive decontamination, with no institution currently
28 performing it routinely. Most providers would want pediatric-specific data before
29 implementing SDD into their practice. Further research to determine the optimal
30 outcome for such studies, including antibiotic resistance profiles, are warranted.
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REFERENCES

1. Gupta S, Boville BM, Blanton R, Lukasiewicz G, Wincek J, Bai C, Forbes ML: **A multicentered prospective analysis of diagnosis, risk factors, and outcomes associated with pediatric ventilator-associated pneumonia.** *Pediatr Crit Care Med* 2015, **16**(3):e65-73.
2. Wheeler DS, Whitt JD, Lake M, Butcher J, Schulte M, Stalets E: **A Case-Control Study on the Impact of Ventilator-Associated Tracheobronchitis in the PICU.** *Pediatr Crit Care Med* 2015, **16**(6):565-571.
3. Gravel D, Matlow A, Ofner-Agostini M, Loeb M, Johnston L, Bryce E, Sample ML, Roth VR, Goldman C, Taylor G *et al*: **A point prevalence survey of health care-associated infections in pediatric populations in major Canadian acute care hospitals.** *Am J Infect Control* 2007, **35**(3):157-162.
4. Banerjee SN, Grohskopf LA, Sinkowitz-Cochran RL, Jarvis WR, National Nosocomial Infections Surveillance S, Pediatric Prevention N: **Incidence of pediatric and neonatal intensive care unit-acquired infections.** *Infect Control Hosp Epidemiol* 2006, **27**(6):561-570.
5. Elward AM, Hollenbeak CS, Warren DK, Fraser VJ: **Attributable cost of nosocomial primary bloodstream infection in pediatric intensive care unit patients.** *Pediatrics* 2005, **115**(4):868-872.
6. Liu B, Li SQ, Zhang SM, Xu P, Zhang X, Zhang YH, Chen WS, Zhang WH: **Risk factors of ventilator-associated pneumonia in pediatric intensive care unit: a systematic review and meta-analysis.** *Journal of thoracic disease* 2013, **5**(4):525-531.
7. Silvestri L, de la Cal MA, van Saene HK: **Selective decontamination of the digestive tract: the mechanism of action is control of gut overgrowth.** *Intensive Care Med* 2012, **38**(11):1738-1750.
8. Muscedere J, Dodek P, Keenan S, Fowler R, Cook D, Heyland D, Committee VAPG, the Canadian Critical Care Trials G: **Comprehensive evidence-based clinical practice guidelines for ventilator-associated pneumonia: diagnosis and treatment.** *J Crit Care* 2008, **23**(1):138-147.
9. Klompas M, Branson R, Eichenwald EC, Greene LR, Howell MD, Lee G, Magill SS, Maragakis LL, Priebe GP, Speck K *et al*: **Strategies to prevent ventilator-associated pneumonia in acute care hospitals: 2014 update.** *Infection control and hospital epidemiology* 2014, **35 Suppl 2**:S133-154.
10. Dellinger RP, Levy MM, Rhodes A, Annane D, Gerlach H, Opal SM, Sevransky JE, Sprung CL, Douglas IS, Jaeschke R *et al*: **Surviving sepsis campaign: international guidelines for management of severe sepsis and septic shock: 2012.** *Crit Care Med* 2013, **41**(2):580-637.
11. de Smet AM, Kluytmans JA, Cooper BS, Mascini EM, Benus RF, van der Werf TS, van der Hoeven JG, Pickkers P, Bogaers-Hofman D, van der Meer NJ *et al*: **Decontamination of the digestive tract and oropharynx in ICU patients.** *N Engl J Med* 2009, **360**(1):20-31.
12. Liberati A, D'Amico R, Pifferi S, Torri V, Brazzi L, Parmelli E: **Antibiotic prophylaxis to reduce respiratory tract infections and mortality in**

adults receiving intensive care. *Cochrane Database Syst Rev* 2009(4):CD000022.

13. Price R, MacLennan G, Glen J, Su DC: **Selective digestive or oropharyngeal decontamination and topical oropharyngeal chlorhexidine for prevention of death in general intensive care: systematic review and network meta-analysis.** *BMJ* 2014, **348**:g2197.
14. Francis JJ, Duncan EM, Prior ME, MacLennan GS, Dombrowski S, Bellingan GU, Campbell MK, Eccles MP, Rose L, Rowan KM *et al*: **Selective decontamination of the digestive tract in critically ill patients treated in intensive care units: a mixed-methods feasibility study (the SuDDICU study).** *Health Technol Assess* 2014, **18**(25):1-170.
15. Duncan EM, Cuthbertson BH, Prior ME, Marshall AP, Wells EC, Todd LE, Bolsover D, Newlands RS, Webster F, Rose L *et al*: **The views of health care professionals about selective decontamination of the digestive tract: an international, theoretically informed interview study.** *J Crit Care* 2014, **29**(4):634-640.
16. Petros A, Silvestri L, Booth R, Taylor N, van Saene H: **Selective decontamination of the digestive tract in critically ill children: systematic review and meta-analysis.** *Pediatr Crit Care Med* 2013, **14**(1):89-97.
17. Burns KE, Duffett M, Kho ME, Meade MO, Adhikari NK, Sinuff T, Cook DJ, Group A: **A guide for the design and conduct of self-administered surveys of clinicians.** *CMAJ* 2008, **179**(3):245-252.
18. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG: **Research electronic data capture (REDCap)--a metadata-driven methodology and workflow process for providing translational research informatics support.** *J Biomed Inform* 2009, **42**(2):377-381.
19. Oostdijk EA, de Smet AM, Blok HE, Thieme Groen ES, van Asselt GJ, Benus RF, Bernards SA, Frenay IH, Jansz AR, de Jongh BM *et al*: **Ecological effects of selective decontamination on resistant gram-negative bacterial colonization.** *Am J Respir Crit Care Med* 2010, **181**(5):452-457.
20. Daneman N, Sarwar S, Fowler RA, Cuthbertson BH, Su DCSG: **Effect of selective decontamination on antimicrobial resistance in intensive care units: a systematic review and meta-analysis.** *Lancet Infect Dis* 2013, **13**(4):328-341.
21. van Nieuwenhoven CA, Buskens E, van Tiel FH, Bonten MJ: **Relationship between methodological trial quality and the effects of selective digestive decontamination on pneumonia and mortality in critically ill patients.** *JAMA* 2001, **286**(3):335-340.
22. Contopoulos-Ioannidis DG, Baltogianni MS, Ioannidis JP: **Comparative effectiveness of medical interventions in adults versus children.** *J Pediatr* 2010, **157**(2):322-330 e317.
23. Halpern SD, Randolph AG, Angus DC: **No child left behind: Enrolling children and adults simultaneously in critical care randomized trials.** *Crit Care Med* 2009, **37**(9):2638-2641.

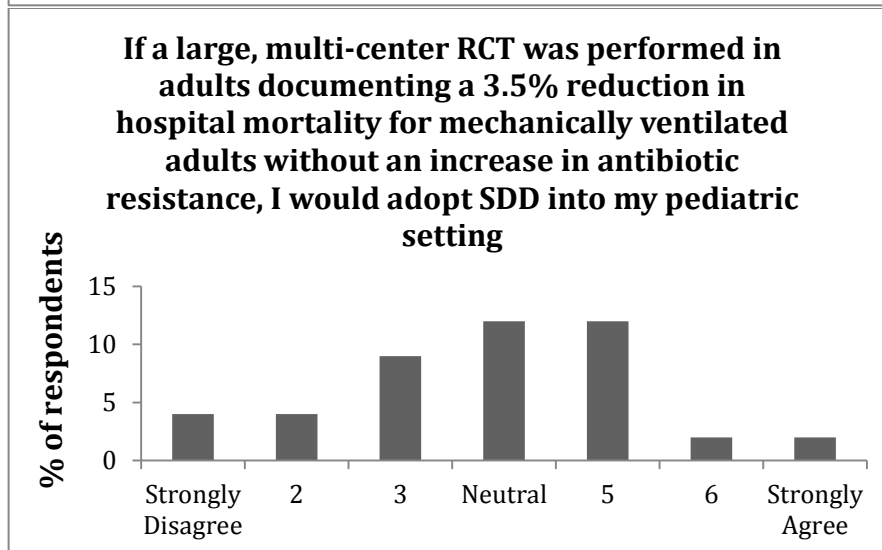
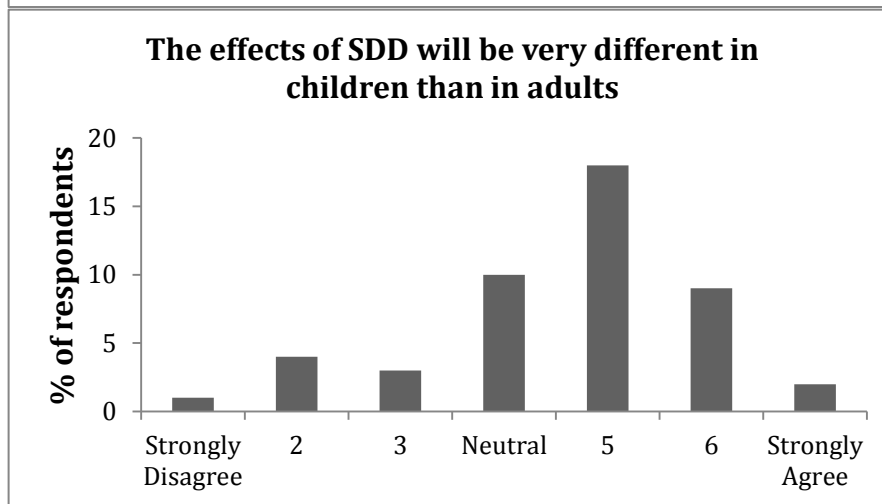
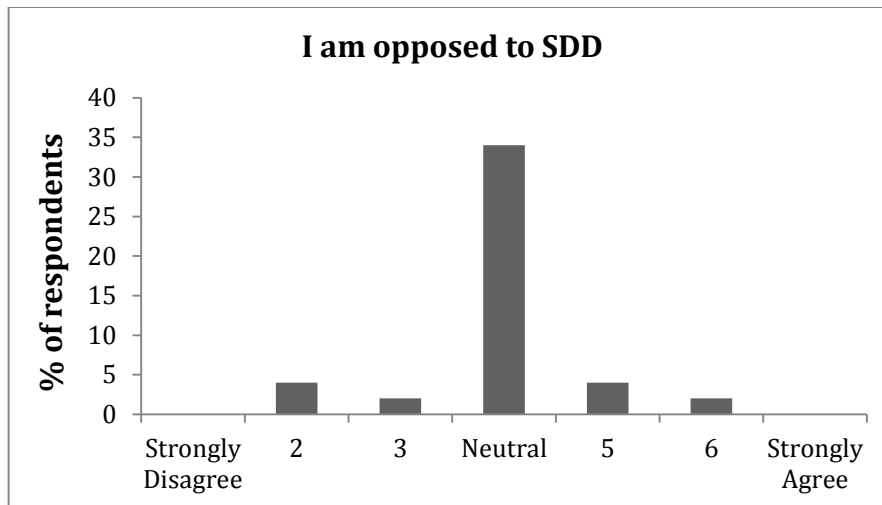


Figure 1: Views about Selective Digestive Decontamination among Canadian providers